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0s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

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Abstract

Background

Nutritional risk screening is typically done in clinical settings to identify individuals at risk of malnourishment. This article presents the first population-level assessment of nutritional risk based on a large national sample representative of Canadian householders aged 65 or older.

Data sources and methods

Data from the 2008/2009 Canadian Community Health Survey—Healthy Aging were used to estimate the prevalence of nutritional risk by selected characteristics. Factors associated with nutritional risk were examined with restricted and full logistic models. The distribution of responses on the SCREEN II-AB nutritional risk instrument is reported.

Results

Based on the results of the 2008/2009 survey, 34% of Canadians aged 65 or older were at nutritional risk. Women were more likely than men to be at risk. Among people with depression, 62% were at nutritional risk, compared with 33% of people without depression. Level of disability, poor oral health, and medication use were associated with nutritional risk, as were living alone, low social support, infrequent social participation, and not driving on a regular basis. Lower income and education were also associated with nutritional risk.

Interpretation

Nutritional risk is common among seniors living in private households in Canada. The characteristics of people most likely to be at nutritional risk provide evidence for targeted screening and assessment.

Keywords

Diet, eating, food intake, malnutrition, morbidity, nutrition assessment, seniors

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Nutritional risk is the risk of poor nutritional status,[1] which lies on a continuum between "nutritional health" [2] and malnutrition. Adults in later life are particularly vulnerable.[3-9] Age-related physiological changes such as diminished appetite and impaired senses—notably, taste and smell—contribute to nutritional risk. Diseases and medications that interfere with the ingestion, absorption and metabolism of food are also factors. Reduced mobility may limit food shopping and meal preparation. Social and economic circumstances—financial constraints, eating alone, and the absence of help with shopping and cooking—may contribute to nutritional risk. Psychological factors such as depression, grief and loneliness are also associated with nutritional risk among older people, as are aspects of the physical environment, such as grocery store locations, the availability and affordability of public transport, and geographic isolation.[10]

Nutritional risk screening helps identify people in need of further assessment and intervention to prevent or reverse the consequences of chronic undernutrition, which can include malnutrition, frailty, falls, hospitalization, institutionalization, and death.[11,13-20] At a population level, nutritional risk screening helps to identify vulnerable sub-populations and modifiable risk factors and provides evidence for policy and targeted community-level programs.[11]

No gold standard has been established for nutritional risk screening,[21] although

several instruments have been developed over the last three decades.[22,23] Among them is *Seniors in the Community Risk Evaluation for Eating and Nutrition* (SCREEN), developed by Dr. Heather Keller of the University of Waterloo, Ontario.[21,24] In cooperation with Dr. Keller, SCREEN was adapted for use in the 2008/2009 Canadian Community Health Survey—Healthy Aging (CCHS-HA), and for the first time, was applied to a representative Canada-wide sample of seniors. Using this screening tool, this study presents the prevalence of nutritional risk among Canadians aged 65 or older, by demographic, social, mental and physical characteristics. The correlates of nutritional risk are examined in bivariate and multivariate logistic models.

Methods

Data source

The 2008/2009 CCHS-HA, a cross-sectional survey designed to collect information on health status and the determinants of healthy aging, covers the household population aged 45 or older in the ten provinces. It excludes people living on reserves and in other Aboriginal settlements; full-time members of the Canadian Forces; residents of collective dwellings; and the institutionalized population. Together, these exclusions represent about 4% of the target population.

CCHS-HA data were collected from December 2008 through November 2009. Computer-assisted personal interviews were conducted for 94% of the sample; telephone interviews were permitted to accommodate respondents' language needs. If, for reasons of physical or mental ill health, respondents were unable to complete the survey, another knowledgeable person was allowed to respond on their behalf; proxy respondents comprise 2.2% of the sample. The household-level response rate was 80.8%, and the person-level response rate was 92.1%, for a combined (household and person) response rate of 74.4%. Details about the CCHS-HA are available on the Statistics Canada website (www.statcan.gc.ca).

Study sample

Of the 30,865 CCHS-HA respondents, 14,496 were younger than 65, another 497 of those who remained relied on proxy respondents, and 203 did not respond to the nutritional risk questions. These three groups were excluded from this analysis. The final study sample of seniors aged 65 or older numbered 15,669 (6,334 men and 9,335 women), with an average age of 77.

Definitions

Nutritional risk was evaluated using *Seniors in the Community Risk Evaluation for Eating and Nutrition II – Abbreviated* (SCREEN II-AB), which has been validated for "cognitively intact community-living seniors" aged 55 or older.[21,25] Nutritional risk questions pertain to weight change, nutrition intake and dietary habits. In cooperation with Dr. Keller, the SCREEN questions were modified to accommodate the change from self-administered to computer-assisted personal interview (Appendix Table A); these questions were pilot-tested before the CCHS-HA was conducted. Values corresponding to the response categories for the eleven component variables were summed for a maximum score of 48; a score below 38 indicates high nutritional risk.

Socio-demographic characteristics included in the analysis were age of the respondent, highest level of education attained by a household member, and household income quintile. The last was based on total household income from all sources in the 12 months before the interview.

Four social characteristics were included in the study: living arrangements, social support, social participation, and driver/non-driver status.

Respondents' living arrangements were classified as living alone or with others.

Social support was measured using the Tangible Support MOS Subscale.[26] Respondents were asked, "How often is support available to you if you need someone to . . .

1. help if you were confined to bed?
2. take you to the doctor if you needed it?
3. prepare your meals if you were unable to do it yourself?
4. help with daily chores if you were sick?

The four questions were answered on a five-point scale: none of the time (score 1), a little of the time (2), some of the time (3), most of the time (4), or all of the time (5). People who responded "none of the time" or "a little of the time" on any of the four questions were classified as having low tangible support.

Social participation was based on respondents' engagement in community-related activities such as church or religious services, sports or physical activities, volunteer work, or cultural events during the past 12 months. Participation in some form of social activity at least once a week was classified as frequent; anything less was considered infrequent.

Respondents were classified as regular drivers if they had a valid driver's license and drove at least once in the past month. Otherwise, they were considered to be non-drivers.

Four characteristics that measured mental and physical well-being were included. Depression was derived from a subset of questions from the Composite International Diagnostic Interview, according to the method of Kessler et al.[27] The questions cover an array of signs and symptoms listed in the *Diagnostic and Statistical Manual of Mental Disorders, Third Revised Edition*,[28] including feeling sad, blue or depressed or losing interest in most things for a period of two weeks or more, feeling tired all the time, weight change, trouble falling asleep or concentrating, feelings of worthlessness, and thoughts about death. The summary score indicates the probability (expressed as a proportion) that the respondent would have been diagnosed as having experienced a major depressive episode in the past 12 months, if they had completed the Long-Form Composite International

Diagnostic Interview. Respondents whose score was equal to or greater than 0.9 were classified as depressed.

Level of disability was based on the Health Utility Index (HUI) developed at McMaster University.[29-31] Functional health, covering vision, hearing, speech, mobility, dexterity, cognition, emotion, pain and discomfort, was scored and categorized into levels of disability: none (1.00), mild (0.89 to 0.99), moderate (0.70 to 0.88), or severe (less than 0.70), and then dichotomized as no/mild disability versus moderate/severe disability.

Oral health was measured by asking respondents about the health of their mouth, which included teeth, dentures, tongue, gums, lips, and jaw joints. People who responded "excellent," "very good," or "good" were compared with those who had "fair" or "poor" oral health.

Table 1
Prevalence of nutritional risk, by sex and selected characteristics, household population aged 65 or older, Canada excluding territories, 2008/2009

	Both sexes			Men			Women		
		95% confidence interval			95% confidence interval			95% confidence interval	
Characteristics	%	from	to	%	from	to	%	from	to
Total	**34.2**	**33.1**	**35.4**	**29.4**	**27.8**	**31.0**	**38.2**‡	**36.6**	**39.8**
Demographic									
Age group									
65 to 74	32.6*	31.0	34.1	28.7	26.6	30.8	36.1*‡	33.8	38.4
75 or older†	36.3	34.8	37.8	30.4	28.0	32.7	40.6‡	38.6	42.6
Education (household)									
Less than postsecondary graduation	38.5*	36.9	40.2	32.7*	30.2	35.3	42.4*‡	40.2	44.6
Postsecondary graduation†	30.5	29.0	32.0	26.8	24.8	28.8	34.1‡	31.9	36.2
Household income quintile									
1	41.8*	39.7	43.9	37.5*	34.0	41.0	44.5*‡	42.0	46.9
2	34.3*	31.9	36.6	29.5	26.2	32.7	38.5*‡	35.1	41.9
3	30.5	27.7	33.2	27.5	23.9	31.0	33.7‡	29.4	38.0
4	27.8	24.3	31.3	25.3	20.5	30.1	31.2	25.5	36.9
5†	26.5	22.3	30.8	26.3	21.2	31.5	26.9	19.2	34.5
Social									
Living arrangements									
Alone	48.9*	47.3	50.6	51.1*	47.9	54.3	48.2*	46.3	50.0
With others†	27.9	26.6	29.3	24.7	22.9	26.4	31.6‡	29.4	33.7
Tangible social support									
High†	30.7	29.5	32.0	26.7	25.0	28.4	34.3‡	32.5	36.2
Low	49.3*	46.6	52.0	45.8*	41.4	50.2	51.1*	47.8	54.4
Social participation									
Frequent†	31.5	30.3	32.8	26.8	24.9	28.7	35.3‡	33.7	36.9
Infrequent	42.8*	40.2	45.4	37.2*	33.8	40.6	47.8*‡	44.4	51.3
Transport									
Regular driver†	31.2	29.9	32.6	28.1	26.4	29.7	35.2‡	33.1	37.3
Non-driver	41.8*	39.7	43.9	39.0*	34.1	43.8	42.5*	40.2	44.8
Mental and physical well-being									
Depression									
Yes	62.4*	54.9	69.9	59.0*	44.8	73.1	64.5*	56.7	72.4
No†	33.2	32.1	34.4	28.5	26.9	30.1	37.1‡	35.5	38.7
Disability									
No/Mild†	27.0	25.6	28.3	24.2	22.4	26.1	29.5‡	27.5	31.4
Moderate/Severe	44.0*	42.1	45.9	37.2*	34.3	40.1	49.0*‡	46.7	51.3
Number of medications used daily in past month									
0 or 1†	28.0	26.4	29.6	25.5	23.1	27.9	30.3‡	28.0	32.5
2 to 4	37.2*	35.6	38.7	31.7*	29.5	33.9	41.6*‡	39.4	43.8
5 or more	54.1*	49.5	58.7	43.0*	35.2	50.9	59.5*‡	54.3	64.8
Oral health									
Good/Very good/Excellent†	32.8	31.6	34.0	28.3	26.6	30.0	36.4‡	34.8	38.0
Fair/Poor	45.5*	41.9	49.1	37.3*	32.3	42.3	53.4*‡	48.7	58.2

† reference category
* significantly different from reference category ($p < 0.05$)
‡ significantly different from men ($p<0.05$)
Source: 2008/2009 Canadian Community Health Survey - Healthy Aging

Respondents were asked about prescription and non-prescription medications taken in the past month, and whether they had been taken on a daily basis. The answers were summed for the number of different types of medications taken daily.

Analytical techniques

CCHS-HA data were weighted to represent the age and sex distribution of the 2008/2009 household population aged 45 or older. The present analysis was limited to respondents aged 65 or older. Cross-tabulations were used to estimate the percentage of the population at nutritional risk by selected characteristics. Unadjusted odds ratios were used to examine each independent variable in relation to nutritional risk. Multiple logistic regression models examined changes in associations in the unadjusted analysis when controlling for socio-demographic, social, and mental and physical health characteristics. To account for survey design effects, coefficients of variation and p-values were estimated, and significance tests performed, using the bootstrap technique.[32,33] The significance level was set at $p<0.05$.

Results

One-third at risk

In 2008/2009, 34% of Canadians aged 65 or older (more than 4.1 million) were at nutritional risk (Table 1). Gaining or losing more than 10 pounds (4.5 kilograms) in the past six months and skipping meals "almost every day" were the main drivers of nutritional risk. Each of these responses resulted in a loss of 8 points on the nutritional risk scale (a loss of 11 or more points from the maximum score of 48 indicates nutritional risk) (Appendix Table A). Beyond the high loss of points associated with these two items, they were commonly reported—among respondents at nutritional risk, 22% had a weight change of more than 10 pounds, and 15% skipped meals almost every day (Table 2). Skipping meals "often" (a loss of 6 points on the scale) was reported by 10% of respondents. Eating fewer than two servings of fruit and vegetables daily (18%), never or rarely eating with someone (23%) and finding cooking a chore (18%) were also common (Table 2), but these items resulted in the loss of fewer points on the nutritional risk scale (Appendix Table A).

Women more likely at risk

A higher percentage of women than men were at nutritional risk: 38% versus 29% (Table 1). Among men, the prevalence of nutritional risk did not differ significantly between age groups, even when other factors were taken into account (Table 3). By contrast, women aged 75 or older were more likely to be at nutritional risk (41%) than were women aged 65 to 74 (36%) (Table 1). But when other factors were taken into account, advancing age was actually associated with lower odds of nutritional risk among women (Table 3).

Socio-economic and social circumstances

In the bivariate analysis, lower household education and income were associated with nutritional risk (Table 1). However, in the multivariate models, lower education and income were not significantly associated with nutritional risk for women (Table 3). For men, only the association with income persisted, with those in the lowest quintile having significantly higher odds of being at nutritional risk than did those in the highest quintile (Table 3).

About half (49%) of people living alone were at nutritional risk, compared with 28% of those who lived with others (Table 1). The difference was particularly large for men, with those living alone twice as likely to be at nutritional risk (51%) than were those living with others (25%).

Anything less than weekly participation in social activities such as religious services, sports or volunteer activities was associated with a higher likelihood of nutritional risk (Table 1). In addition, people who lacked someone to support them in practical matters such as help with meals or chores were more likely to be at risk.

Living alone, infrequent social participation and low social support all remained significantly associated with nutritional risk when demographic factors and mental and physical well-being were taken into account (Table 3). Although the ability to drive was associated with nutritional risk in the initial analysis, this association was not significant when all other characteristics were considered together.

Physical and mental health

Among seniors who were depressed, 62% were at nutritional risk (Table 1). This was substantially higher than among those who were not depressed: 33%. The association remained in the multivariate models; the odds of being at nutritional risk were more than twice as high for men and women with depression as for those without depression (Table 3).

Disability was also a factor: 44% of people with moderate or severe disability were at nutritional risk, compared with 27% of those with no or mild disability. The more types of medications people used on a daily basis, the more likely they were to be at nutritional risk. Among people who took no or just one type of medication daily, 28% were at risk; for those who took five or more medications a day, the percentage was 54%. Level of disability and medication use remained significantly associated with nutritional risk in the multivariate models.

In the initial analysis, people who rated their oral health as fair or poor were more likely to be at nutritional risk (Table 1). When other factors were taken into account, oral health remained significantly associated with nutritional risk for women, but not for men (Table 3).

Discussion

According to results from the CCHS-HA, 34% of Canadian seniors were at nutritional risk in 2008/2009. This figure is low compared with the results of other research.[5,16,34-38] Keller and McKenzie,[35] for example, reported that 69% of their

Table 2
Percentage distribution of nutritional risk items, by nutritional risk status and and sex, household population aged 65 or older, Canada excluding territories, 2008/2009

	Both sexes				Men				Women			
	At nutritional risk		Not at nutritional risk		At nutritional risk		Not at nutritional risk		At nutritional risk		Not at nutritional risk	
Nutritional risk items	%	Standard error	%	Standard error	%	Standard error	%	Standard error	%	Standard error	%	Standard error
Weight change												
Lost/Gained more than 10 pounds	22.0*	0.9	1.9	0.2	21.4*	1.3	2.7	0.3	22.4*	1.1	1.1†	0.2
Lost/Gained 5 to 10 pounds	25.4*	0.8	8.2	0.4	22.6*	1.2	8.2	0.7	27.2*†	1.1	8.2	0.6
Lost/Gained less than 5 pounds	4.8*	0.4	6.3	0.4	4.0†	0.7	4.9	0.5	5.3*	0.5	7.5†	0.5
Same weight	47.4*	0.9	83.7	0.6	51.8*	1.6	84.2	0.9	44.7*†	1.2	83.2	0.8
Appetite												
Poor	6.7	0.5	F	..	5.1	0.6	F	..	7.7	0.6	F	..
Fair	20.7*	0.8	4.7	0.3	17.1*	1.2	4.1	0.5	23.0*†	1.1	5.2	0.4
Good	48.9*	1.0	44.8	0.8	51.0*	1.6	42.0	1.1	47.6	1.2	47.4†	1.0
Very good	23.7*	0.9	50.4	0.8	26.9*	1.4	53.7	1.2	21.7*†	1.1	47.2†	1.0
Cough, choke or have pain when swallowing food or fluid												
Often/Always	6.6*	0.5	0.4†	0.1	6.5	0.7	F	..	6.6	0.6	F	..
Sometimes	19.8*	0.8	3.2	0.3	17.7*	1.3	3.2	0.4	21.1*†	1.0	3.1	0.4
Rarely	18.4*	0.8	15.0	0.6	20.0*	1.3	16.3	0.9	17.4*	1.0	13.8†	0.8
Never	55.2*	1.1	81.4	0.7	55.8*	1.7	80.1	1.0	54.8*	1.3	82.7†	0.8
Skips meals												
Almost every day	14.7*	0.7	0.7†	0.1	17.9*	1.2	0.9†	0.2	12.7†	0.8	F	..
Often	9.7*	0.6	0.9†	0.2	10.6*	1.0	1.0†	0.2	9.1*	0.7	0.8†	0.2
Sometimes	24.0*	0.9	7.6	0.4	24.8*	1.4	8.2	0.6	23.5*	1.1	7.0	0.5
Never or rarely	51.6*	1.0	90.8	0.5	46.7*	1.6	89.9	0.7	54.6*†	1.3	91.6	0.6
Fruit and vegetable servings per day												
Less than 2	17.5*	0.8	4.4	0.3	24.8*	1.5	6.2	0.5	13.0*†	0.8	2.8†	0.3
2	19.6*	0.8	9.5	0.4	22.3*	1.4	12.1	0.7	17.8*†	1.0	7.1†	0.5
3	20.6*	0.8	16.8	0.6	19.8	1.2	17.6	0.8	21.1*	1.0	16.1	0.8
4	18.0*	0.7	22.6	0.7	14.7*	1.2	22.8	1.1	20.0†	0.9	22.3	0.9
5 or more	24.4*	0.9	46.7	0.8	18.4*	1.3	41.3	1.2	28.2*†	1.2	51.7†	1.1
Fluid consumed per day (cups)												
Less than 2	1.1*‡	0.2	0.3‡	0.1	1.2‡	0.3	F	..	1.0*‡	0.3	0.4‡	0.1
About 2	3.9*	0.4	1.0	0.1	3.7*	0.6	1.2‡	0.2	3.9*	0.6	0.8†	0.2
3 to 4	25.1*	0.9	15.1	0.5	27.5*	1.4	15.6	0.8	23.7*†	1.1	14.6	0.8
5 to 7	41.0	1.1	43.5	0.8	40.0	1.7	44.0	1.2	41.6	1.3	43.1	1.1
8 or more	28.9*	1.0	40.1	0.8	27.7*	1.5	38.8	1.1	29.7*	1.2	41.2	1.1
Eats with someone												
Almost always	51.7*	1.0	77.0	0.6	62.5*	1.5	86.8	0.7	45.0*†	1.3	67.8†	1.0
Often	6.1	0.5	5.5	0.3	4.5	0.6	4.0	0.4	7.1†	0.7	6.9†	0.5
Sometimes	18.8*	0.7	10.8	0.4	12.9*	1.0	5.3	0.4	22.5*†	1.0	16.0†	0.6
Never or rarely	23.4*	0.8	6.8	0.3	20.1*	1.3	4.0	0.4	25.4*†	0.9	9.4†	0.5
Attitude to cooking (among those who normally cook their own meals)												
Usually a chore	18.4*	0.8	3.8	0.4	19.2*	1.6	3.8†	0.7	18.1*	1.0	3.8	0.4
Sometimes a chore	33.3*	1.1	20.5	0.8	28.9*	1.9	12.1	1.0	34.9*†	1.2	23.4†	1.0
Enjoy cooking	48.3*	1.1	75.7	0.8	51.9*	2.1	84.1	1.2	47.0*†	1.3	72.8†	1.1
Satisfied with quality of food prepared by others (among those who normally do not cook their own meals)												
Yes	95.7*	0.8	99.1	0.2	98.0*	0.5	99.2	0.2	89.2*†	2.4	98.4	0.9
No	4.3*‡	0.8	0.9†	0.2	2.0*‡	0.5	0.8†	0.2	10.8*†	2.4	F	..

* significantly different from not at nutritional risk ($p<0.05$)
† significantly different from men in same nutritional risk category ($p<0.05$)
‡ interpret with caution
F too unreliable to be published
.. not applicable
Source: 2008/2009 Canadian Community Health Survey - Healthy Aging

Table 3
Unadjusted and adjusted odds ratios relating selected characteristics to nutritional risk, by sex, household population aged 65 or older, Canada excluding territories, 2008/2009

	Men					Women				
	Unadjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval		Unadjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval	
Characteristics		from	to		from	to		from	to		from	to
Demographic												
Age group												
65 to 74†	1.00	...	...	...	...	...	1.00	...	...	...	...	...
75 or older	1.08	0.93	1.26	...	...	...	1.21*	1.07	1.37	...	...	...
Age (continuous)	1.01	1.00	1.02	0.99	0.98	1.00	1.01*	1.00	1.02	0.98*	0.97	0.99
Education												
Less than secondary school graduation	1.31*	1.12	1.53	0.96	0.80	1.15	1.42*	1.26	1.61	1.11	0.96	1.29
Secondary school graduation†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Income quintile												
1	1.79*	1.44	2.22	1.46*	1.16	1.85	1.49*	1.26	1.76	1.09	0.92	1.30
2	1.24	1.00	1.55	1.18	0.94	1.48	1.16	0.96	1.42	1.14	0.93	1.41
3	1.13	0.89	1.43	1.15	0.90	1.47	0.95	0.74	1.21	1.01	0.78	1.29
4	1.01	0.75	1.36	1.06	0.78	1.46	0.85	0.62	1.15	1.06	0.78	1.45
5†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Social												
Living arrangements												
Alone	3.19*	2.73	3.73	2.86*	2.39	3.42	2.01*	1.78	2.27	1.85*	1.61	2.12
With others†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Tangible social support												
High†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Low	2.30*	1.89	2.80	1.31*	1.06	1.62	1.96*	1.68	2.29	1.49*	1.26	1.75
Social participation												
Frequent†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Infrequent	1.62*	1.36	1.93	1.46*	1.20	1.76	1.68*	1.44	1.95	1.43*	1.22	1.69
Transport												
Regular driver†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Non-driver	1.64*	1.32	2.04	1.12	0.87	1.43	1.37*	1.20	1.55	1.11	0.96	1.28
Mental and physical well-being												
Depression												
Yes	3.58*	1.96	6.54	2.77*	1.51	5.06	3.06*	2.14	4.37	2.21*	1.54	3.17
No†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Disability												
No/Mild†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Moderate/Severe	1.85*	1.58	2.17	1.59*	1.32	1.90	2.30*	2.02	2.61	1.82*	1.58	2.11
Number of medications used daily in past month												
0 or 1†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
2 to 4	1.34*	1.14	1.58	1.31*	1.10	1.56	1.60*	1.40	1.84	1.42*	1.23	1.63
5 or more	2.18*	1.54	3.11	1.69*	1.17	2.44	3.31*	2.60	4.23	2.23*	1.71	2.91
Oral health												
Good/Very good/Excellent†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Fair/Poor	1.51*	1.20	1.89	1.19	0.94	1.52	2.00*	1.64	2.44	1.54*	1.27	1.88

† reference category
* significantly different from reference category ($p < 0.05$)
... not applicable
Source: 2008/2009 Canadian Community Health Survey - Healthy Aging

study sample was at nutritional risk. However, this and other studies focused on vulnerable populations such as those who are hospitalized, in nursing homes, attending clinics, or receiving support from community agencies.[5,36] By contrast, seniors who remain in private households comprise a relatively healthy cohort, among whom the risk of nutritional depletion would be expected to be lower. In addition, the various studies used a range of different instruments to estimate nutritional risk.

This analysis shows that women are more likely than men to be at nutritional risk. Although not all studies report such gender differences, CCHS-HA findings are consistent with several earlier analyses,[38-40] including one focusing on community-living Canadians.[35] The gender differences in the present study cannot be accounted for by the older age profile of senior women, because in both age groups, women were more likely than men to be at nutritional risk. Biological differences may play a role; age-related changes in body composition differ between men and women.[41] For women, time since menopause is associated with weight gain,[41] and changes in weight contribute to the nutritional risk score. And even at older ages, body image continues to be important, which may lead to restrictive diets, and so to nutritional risk.[5] Women are more likely than men to take medications,[42] which may affect appetite or the absorption and metabolism of food. However, women are no more likely than men to use multiple medications, which may increase the possibility of drug-drug or drug-food interactions that may have nutritional consequences.[40,42,43] Pain and depression, both of which are more common in women, can also impair appetite and eating.[8,44-46]

While nutritional depletion is a particular concern at older ages,[40,43,47] the multivariate models did not provide evidence of greater risk among the older population groups. On the contrary, for women, when other possible confounders were taken into account, the odds of being at risk decreased with age. These counterintuitive results likely reflect the relatively healthy cohort of seniors who continue to live in private households.

Education and income—markers of socio-economic status—were associated with nutritional risk in the bivariate analysis, and, to a lesser extent, in the multivariate models. Higher levels of education may be protective through a history of more positive health behaviours, a greater sense of control over choices and outcomes, more informed nutritional choices, and better access to financial and other resources.[2] Lower-income seniors may cut back on necessities, including the quality and quantity of food consumed.[40,48]

It is widely reported that people who live alone are more likely to be at nutritional risk, a finding supported by the CCHS-HA. Living alone may signal social isolation, which has been linked to poor nutrition.[2] People who are isolated may lack social support, including help with practical matters such as cooking and transport for shopping or social activities. Results from the CCHS-HA substantiate these associations: non-drivers, people with low tangible support, and those who rarely participated in social events were all more likely to be at nutritional risk.

Living alone, however, may not place people at nutritional risk so much as the transition to solo living from an earlier arrangement.[49] The present analysis distinguishes only between living alone and living with others. Davis et al. found that in terms of nutrient intake, living with a spouse was best, and living with people other than one's spouse was worse than living alone.[50] Loss of a spouse through death or divorce may result in grief, loneliness or depression, a loss of social support, reduced social participation, lower income and so on, all of which may affect nutritional status.[2,51] Results from this study indicate that people living alone may be an important target group for nutritional risk screening. Social participation and tangible support are modifiable factors that may reduce nutritional risk.

The relationship between mental illness and impaired nutrition is well-established.[37,40,49] Based on the CCHS-HA, depression was associated with nutritional risk, as were other measures of well-being including medication use and disability. Disability may contribute to or be a consequence of nutritional depletion.[38] Further longitudinal analysis is required to establish the temporal order of disability and nutritional risk, although a bidirectional relationship likely exists: nutritional

What is already known on this subject?

- Nutritional risk is a health concern for vulnerable seniors in the community and those admitted to hospitals, nursing homes, and other care facilities.
- For a wide range of reasons, including physical and mental conditions and social and economic circumstances, nutritional status may be compromised.
- Nutritional risk screening identifies individuals for further assessment to help prevent or address a downward trajectory to malnutrition and other threats to health.

What does this study add?

- An estimated 34% of Canadians aged 65 or older who reside in private households are at nutritional risk.
- Women are more likely than men to be at nutritional risk: 38% versus 29%.
- The likelihood of nutritional risk is almost double for people with depression (62%), compared with people without depression (33%).
- Social characteristics, including living alone, low social support and infrequent social participation, are associated with nutritional risk for Canadian seniors.

deficiencies leading to weight loss and functional decline could interfere with activities such as eating, shopping and cooking, and thereby, contribute to nutritional risk.[2,18,43,47]

People who assessed their oral health as fair or poor were more likely than those who did not to be at nutritional risk. When other factors were taken into account, this association remained for women, but not for men. The ability to chew and the importance of teeth is emphasized by Suzuki et al.[52] who found compromised nutritional intake among those with fewer teeth. This is relevant for senior Canadians—in 2003, 58% of men and 66% of women wore dentures; 30% reported complete tooth loss.[53] In addition to tooth loss, reduced salivary flow, periodontal disease, dental caries and other conditions can limit food selections and nutrient intake.[6] It is important to note that coughing, choking or having pain when swallowing food or fluid (SCREEN II-AB item) is not sufficient to be categorized as at nutritional risk; other factors must also be present. The association between oral health and nutritional risk reveals both a modifiable factor and a target population for screening.

Limitations

The SCREEN II-AB instrument does not discriminate between respondents at risk of becoming nutritionally depleted and those who already are undernourished. Consequently, in this study, respondents scoring below the established cut-off of 38 on the scale were considered "at nutritional risk," with some possibly having already progressed beyond the point of risk.

Because of the cross-sectional design of the CCHS-HA, the temporal order of covariates and nutritional risk cannot be established. Some variables treated as antecedents in this study may, in reality, be outcomes of nutritional risk. For example, disabilities may result from, rather than contribute to, nutritional depletion.[35]

CCHS-HA data are self-reported and not verified by any other source.

Comparisons with other studies are hampered by the range of instruments used to measure nutritional risk. Differences in scale items, scoring systems, and cutoff points reduce the comparability of prevalence estimates.

Readily available transportation that facilitates grocery shopping may have an impact on nutritional risk. To this end, respondents were classified as drivers or non-drivers. However, being a passenger is the main form of transportation for many non-drivers,[54] and their ease of purchasing groceries may be similar to that of regular drivers. Classifying regular passengers with other non-drivers may overstate the prevalence of transportation restrictions and weaken the association with nutritional risk.

The association between living alone and nutritional risk may be explained, in part, by a correlation between living alone and eating alone, the latter of which partly defines nutritional risk in SCREEN II-AB. Nonetheless, a subanalysis revealed that when eating alone was removed from the scale, those who lived alone were still more likely to be at nutritional risk than those who lived with others (data not shown).

Conclusion

Identification of vulnerable groups and establishing factors that are associated with nutritional problems provide evidence for targeted screening. Information from this study can increase awareness about seniors and nutrition. ■

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Appendix

Table A
Nutritional risk questions and response categories in Canadian Community Health Survey-Healthy Aging (CCHS-HA) and SCREEN II-AB

Item number	CCHS-HA†	SCREEN II - AB
	Question **Response categories (points)**	**Question** **Response categories**
1	**1. Compared with 6 months ago, have you gained weight, lost weight or stayed about the same?** Stayed the same (8) Don't know (0) Gained weight (0) Lost weight (0) **2. How much weight did you lose/gain in the past 6 months?** More than 10 pounds / 4.5 kilos (0) 6 to 10 pounds / 2.7 to 4.5 kilos (2) About 5 pounds / 2.3 kilos (4) Less than 5 pounds / 2.3 kilos (8)	**Has your weight changed in the past 6 months?** Yes, I gained more than 10 pounds Yes, I gained 6 to 10 pounds Yes, I gained about 5 pounds No, my weight stayed within a few pounds Yes, I lost about 5 pounds Yes, I lost 6 to 10 pounds Yes, I lost more than 10 pounds I don't know how much I weigh or if my weight has changed
2	**3. In general, how often do you skip meals?** Almost every day (0) Often (2) Sometimes (4) Never or rarely (8)	**Do you skip meals?** Almost every day Often Sometimes Never or rarely
3	**4. In general, how would you describe your appetite?** Poor (0) Fair (4) Good (6) Very good (8)	**How would you describe your appetite?** Poor Fair Good Very good
4	**5. In general, how often do you cough, choke or have pain when swallowing food or fluid?** Often or always (0) Sometimes (2) Rarely (6) Never (8)	**Do you cough, choke or have pain when swallowing food or fluids?** Often or always Sometimes Rarely Never
5	**6. In general, how many servings of fruits and vegetables do you eat in a day?** Less than two (0) Two (1) Three (2) Four (3) Five (4) Six (4) Seven or more (4)	**How many pieces or servings of fruit and vegetables do you eat in a day?** Less than two Two Three Four Five or more
6	**7. How much fluid do you drink in a day?** Less than two cups (0) About two cups (1) Three to four cups (2) Five to seven cups (3) Eight or more cups (4)	**How much fluid do you drink in a day?** Less than two cups About two cups Three to four cups Five to seven cups Eight or more cups
7	**8. How often do you eat at least one meal each day with someone?** Never or rarely (0) Sometimes (2) Often (3) Almost always (4)	**Do you eat one or more meals a day with someone?** Never or rarely Sometimes Often Almost always
8	**9. Do you usually cook your own meals?** No Yes **10. Which of the following statements best describes meal preparation for you?** I usually find cooking a chore (0) I sometimes find cooking a chore (2) I enjoy cooking most of my meals (4) **11. Which of the following statements best describes the meals prepared for you?** I'm not satisfied with the quality of the food prepared by others (0) I'm satisfied with the quality of the food prepared by others (4)	**Who usually prepares your meals?** Someone else cooks most of my meals I share my cooking with someone else I do **Which statement best describes meal preparation for you?** I usually find cooking a chore I sometimes find cooking a chore I enjoy cooking most of my meals **Which statement best describes meal preparation for you?** I'm not satisfied with the quality of the food prepared by others I'm satisfied with the quality of the food prepared by others

† Based on the Seniors in the Community Risk Evaluation for Eating and Nutrition II – Abbreviated (SCREEN II-AB) developed by Dr. Heather Keller of the University of Waterloo, Ontario and adapted, with permission, for computer-assisted interviewing in the CCHS-HA.